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Proceedings of the Pacific regional peer review on Recommendations for the Identification of Critical Habitat for Speckled Dace

April 19th, 2012
Nanaimo, British Columbia

Chairperson: Sean MacConnachie
Editor: Sean MacConnachie

Fisheries and Oceans Canada
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Canada

Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

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SUMMARY

These Proceedings summarize the relevant discussions and key conclusions that resulted from a Fisheries and Oceans Canada (DFO), Canadian Science Advisory Secretariat (CSAS) Regional Advisory meeting held on April 19th, 2012 at the Pacific Biological Station in Nanaimo, BC. One working paper focusing on recommendations for critical habitat for Speckled Dace (*Rhinichtys osculus*) was presented for peer review.

In-person and web-based participation included DFO Science and Ecosystem Management branches staff, and external participants from the Province of BC, the forestry industry and independent scientists.

The conclusions and advice resulting from this review will be provided in the form of a Science Advisory Report (SAR) providing advice to the DFO species at risk program to inform the eventual identification of critical habitat for Speckled Dace.

The SAR and the supporting Research Document will be made publicly available on the Canadian Science Advisory Secretariat (CSAS) website.

Compte rendu de l'examen par les pairs de la Région du Pacifique sur les recommandations concernant la désignation de l'habitat essentiel du naseux moucheté

SOMMAIRE

Le présent compte rendu résume l'essentiel des discussions et les principales conclusions de la réunion régionale consultative du Secrétariat canadien de consultation scientifique (SCCS) de Pêches et Océans Canada (MPO), qui a eu lieu le 19 avril 2012 à la Station biologique du Pacifique de Nanaimo, en Colombie-Britannique. On présente un document de travail sur les recommandations concernant l'habitat essentiel du naseux moucheté (*Rhinichtys osculus*), aux fins d'examen par les pairs.

Parmi les participants à la réunion en personne et par cyberconférence se trouvaient des employés des directions des Sciences et de la Gestion des écosystèmes du MPO, des participants externes de la province de la Colombie-Britannique et de l'industrie forestière, et des scientifiques indépendants.

Les conclusions et avis découlant de cet examen seront présentés au Programme des espèces en péril du MPO sous forme d'un avis scientifique afin d'éclairer la détermination éventuelle de l'habitat essentiel du naseux moucheté.

L'avis scientifique et le document de recherche à l'appui seront rendus publics sur le site Web du calendrier des avis scientifiques du Secrétariat canadien de consultation scientifique (SCCS).

INTRODUCTION

A Fisheries and Oceans Canada (DFO) Canadian Science Advisory Secretariat (CSAS), Regional Advisory Process (RAP) meeting was held on April 19th, 2012 at the Pacific Biological Station in Nanaimo to review recommendations on the identification of critical habitat for Speckled Dace (*Rhinichtys osculus*).

The Terms of Reference (TOR) for the science review (Appendix C) were developed in response to a request for advice from the Species at Risk program in the Ecosystem Management Branch. Notifications of the science review and conditions for participation were sent to representatives with relevant expertise from the Province of BC, independent scientists, environmental non-governmental organizations and academia.

The following working paper was prepared and made available to meeting participants prior to the meeting:

Brown, T. and B. Harvey. 2012. Information in the support of the identification of critical habitat for Speckled Dace (*Rhinichthys osculus*). CSAP Working Paper 2011/P54

The meeting Chair, Sean MacConnachie, welcomed participants, reviewed the role of CSAS in the provision of peer-reviewed advice, and gave a general overview of the CSAS process. The Chair discussed the role of participants, the purpose of the various RAP publications (Science Advisory Report, Proceedings and Research Document), and the definition and process around achieving consensus decisions and advice. Everyone was invited to participate fully in the discussion and to contribute knowledge to the process, with the goal of delivering scientifically defensible conclusions and advice. It was confirmed with participants that all had received copies of the Terms of Reference, and working paper.

The Chair reviewed the Agenda (Appendix A) and the Terms of Reference (Appendix C) for the meeting, highlighting the objectives and identifying the Rapporteur for the review. The Chair then reviewed the ground rules and process for exchange, reminding participants that the meeting was a science review and not a consultation. The room was equipped with microphones to allow remote participation by web-based attendees, and in-person attendees were reminded to address comments and questions so they could be heard by those online.

Participants were reminded that everyone at the meeting had equal standing and that they were expected to contribute to the review process if they had information or questions relevant to the paper being discussed. In total, 14 people participated in the RAP (Appendix B). Ryan Abbott was identified as the Rapporteur for the meeting.

Participants were informed that two reviewers had been asked before the meeting to provide detailed written reviews for the working paper to assist everyone attending the peer-review meeting. Participants were provided with copies of the written reviews.

The conclusions and advice resulting from this review will be provided in the form of Science Advisory Report (SAR) to Ecosystem Management Branch to inform the identification of critical habitat for Speckled Dace. The SAR and the supporting Research Document will be made publicly available on the CSAS Science Advisory Schedule.

REVIEW

Working Paper: Brown, T. and B. Harvey. 2012. Information in the support of the identification of critical habitat for Speckled Dace (*Rhinichthys osculus*). CSAP Working Paper 2011/P54

Rapporteur: Ryan Abbott

Presenter: Thomas Brown

PRESENTATION OF WORKING PAPER

Thomas Brown presented the working paper. His presentation included the following:

- photos and descriptions of both Speckled Dace and its habitat in the Kettle River
- indicated that the Canadian population only represents a small (<5%) portion of the global population
- discussed the Batty (2010) population estimate, greater population than previously estimated
- identified knowledge gap in terms of winter behaviour (do they migrate?)
- discussed biology (diet, residence, lifespan, thermal tolerance, timing of spawning, habitat preference)
- described the geophysical characters of the river ("bowling alley effect" – mounds of sediment in the middle of the channel with water flowing on either side, small amount of large woody debris, mobile substrate)
- discussed COSEWIC (2002, 2006, Harvey 2007) assessments of Speckled Dace
- Brown indicated he questioned the COSEWIC finding of increased water demand in the Kettle drainage
- mentioned more recent papers on Speckled Dace (Batty (2010), Andrusak and Andrusak (2011))
- spoke about threats
- lack of available habitat at low water because of water withdrawal, which may be the only *real* major threat
- likely affected be a climactic shift towards dryer summers
- low water effect exacerbated by porous, mobile substrate
- sedimentation, mostly historic in origin, due to mining. Also some sedimentation due to cattle ranches, logging roads.
- he indicated that alien invasive species may not be much of a threat yet, in the future this may become *the* threat
- dams
- discussed recovery targets and gave some justification for using the number 7000 as a target
- walked through the calculations for determining density and thus, how much linear river needs to be protected in order maintain the population above that 7000 individual target
- opened the floor to discussion about how what to set as the target (i.e. distribution? population? do the fish in the west and east Kettle and the Grandby Rivers mix?)
- "Should we divide the critical habitat between the three rivers in order to maintain 7000 individuals? or should it all be in one?"

- discussed location of critical habitat: indicated that it should be placed above any major threats, while still within the distributional range of the species
- this will require three population assessments to verify that there is actually something there
- showed and described a map of the three tributaries with the suggested critical habitat highlighted
- Brown drew attention to an order of magnitude error on the map (actual critical area is 10X smaller than what is shown)

Mike Bradford followed up the presentation with a few comments about the population estimate performed by his student Adam Batty in 2010. He provided background on the estimation methods including sites tested, single pass electrofishing, and mark recapture studies. The recovery rate determined from the mark recapture study was used to expand the electrofishing estimates into a total density estimate. He indicated that these estimates were done during the day and nighttime results may have been different.

POINTS OF CLARIFICATION

The amount of work required to perform the population estimates needed to determine presence (or absence) of dace in the proposed areas of critical habitats was discussed. Amount of time required and strengths and weaknesses of different methods available were discussed.

Certain members of the meeting needed clarification on the map.

One participant noted that a water POD (point of diversion) is usually upstream of the irrigation point. So area may be threatened upstream of irrigation, and thus needs protection.

The authors discussed discrepancies between the map provided in the working paper and the map used in the Batty (2010) thesis; some points on the working paper map show no fish caught when really there were fish caught at that point.

When questioned about placement of critical habitat at the obvious places of high abundance, the authors indicated that this had been unsuccessfully attempted.

WRITTEN REVIEWS

JORDAN ROSENFELD

Riparian Habitat

Dr Rosenfeld discussed whether or not riparian habitat is critical. He reminded the authors that channel size is inversely related to the importance of riparian habitat. Essentially he indicated that there needs to be a clear chain of logic that results in either riparian being deemed important (i.e., for reducing sedimentation and bank stabilization) or that riparian does not affect this species.

In reference to sediment, he reminded the authors that, because much of the sediment is thought to be from mining operations, the effects of sedimentation will change over time (i.e., sand bars will move).

When large woody debris (LWD) was discussed, one of the authors interjected with a comment about the biology of Cottonwood trees, and why they are not significant as LWD. Rosenfeld indicated that, in his view, Cottonwoods may be important.

Rosenfeld's main point with regard to riparian was that there should be serious consideration given to its importance as Speckled Dace critical habitat, and the authors should do a better job of justifying why it was not considered important.

Comments were made about the current state of the riparian habitat and how it is now different from its historical state. This is largely due to land use such as agriculture, and to a lesser extent from fire.

Rosenfeld indicated that there appears to be a discrepancy in regard to flow preference. Batty said one thing while Andrusak said the opposite. This needs clarification in the report.

Recovery Targets

Rosenfeld stressed the importance of recognizing that there is a difference between science and policy when defining recovery targets. For example, use of minimum viable population (MVP) as a target is a policy decision.

A major point of this section was that choosing to use a MVP as a target only makes sense is the species is currently below that target, but it doesn't really make sense for a species that is already way above this number. Therefore, it may make more sense to set the target as maintaining current distribution and abundance.

Rosenfeld was disturbed by the statement in the working paper: "the term 'recovery goal' is irrelevant for this species".

He advised that the authors need to make a better case that their proposed area of critical habitat will meet the population and distribution objectives.

He suggested designating the whole length of the distribution critical habitat, which was met with some opposition due to the fact that that option is not pragmatic. Rosenfeld responded by suggesting that the authors say why the entire length cannot be protected – rationalize the decision. Also, rationalize why you choose the patches of river that you choose.

He understood that there are some knowledge gaps in areas that could inform the decision of where to place critical habitat. The authors agreed and recognized that there should be studies done to determine migration patterns.

In finishing Rosenfeld questioned the authors about a citation of "DFO 2011", which was not listed in the references. The authors discussed potentially just calling this "DFO policy" or citing it as "pers. com." or "personal cite".

A question was asked of Jordan in regards to his sufficiency of conservation objectives. Did he find the 2008 RPA objectives to be sufficient? His response was that the RPA was only referred to because it was a reference in the working paper. His goal was to indicate that there is a difference between a distributional goal and a population goal.

HEATHER STALBERG

This reviewer agreed with the authors in their approach to identifying critical habitat based on a conservation target.

She found the map to be helpful but suggested including the metadata.

One discussed suggestion was to structure the document in a way that allows the policy makers to readily grasp the information and utilize it in a recovery plan.

Recovery targets

She agrees with setting a conservation target for maintenance of the population is appropriate.

Identifying Critical Habitat

There must be clarity about whether it is going to be one long stretch of protected habitat or will that be split amongst all three of the tributaries. Also show the calculations (refer to point 2 under key comments in Stalbergs review paper in the appendix).

Based on work cited by the authors, Stalberg has come to the conclusion that there would be rescue potential for the fish if one stream was compromised by a catastrophic event.

Table 3 in the working paper: While she found it useful, Stalberg had several suggestions about how to improve the table. See point 5 under key comments in Stalberg's review paper in the appendix. She spoke to including the table in the narrative of the document.

Important habitat attributes was confusing as to what is important and what is critical. There should be definitions for both.

Threats

Stalberg suggested clearly prioritizing threats. Also, she encouraged the authors to look at potential alien species' effects on the ecosystem, and not just on the dace population. She indicated that the prioritization of threats be kept consistent in order to makes it smoother for those writing the recovery strategy.

She spoke of water withdrawal. Substantiate evidence for claims of water demand/water withdrawal.

It was unclear for Stalberg how the fire interval related to critical habitat. Also, she suggested coupling the impact of pine beetle infestation and harvest logging. She offered a paper that talks about this.

In general, it seemed as though Stalberg wanted to see prioritized threats and higher resolution of the diversity of threats.

Put the service that the riparian provides (or doesn't provide) into an appendix.

She suggested combining section 10 Knowledge Gaps with section 11 Schedule of Studies under the title Future Studies. She also suggested changing the name of the document.

POINTS OF CLARIFICATION

In reference to threats, there was some discussion about defining specific locations of threats rather than just generally stating what the threats are without reference to location. It was admitted by the authors that other than point threats such as the Grand Forks sewage treatment outflow and the Cascade Falls hydroelectric project were not identified. The indicated that they are low on information about specific strips of river, and what they know is more generally applicable to the whole Kettle drainage.

Stalberg appreciated the broader approach to identifying threats. She suggested admitting not knowing where the critical habitat will be, but that you know what the critical habitat needs (features, function and attributes). This could guide where the habitat will go.

In reference to the use of the term maintenance of the population, it was questioned whether she meant maintenance of the MVP or maintenance of the current population (~1M). This needs clarity.

One participant questioned Stalberg's statement that "the length of stream determined to generate 7000 individuals will be conservative (likely producing more than 7000 individuals) because, even beyond correcting for catch efficiency, Batty's 2010 density estimates might have been biased to capturing smaller and less individuals due to use in the daytime vs. the nighttime and, there were spans of river not sampled which could also influence range and abundance." He disagreed because capture efficiency should correct for any biases. Therefore the population estimates shouldn't be underestimates and 7000 may not necessarily be conservative.

One of the authors discussed his work with Batty (2010) and mentioned that their objective was to determine if the population was above COSEWIC's 10000 number, which it was even if you consider the huge confidence interval.

GENERAL DISCUSSION

To start the discussion, the chair summarized where the meeting stood as far as what had been said in the morning and what was known about speckled dace. He spoke of the increase in population estimates over the past few years and the fact that we have no picture of what the population or distribution or habitat looked like pre-contact.

The group was questioned if they felt that 7000 animals is an appropriate number to use as a target. Is this sufficient?

Some felt that this question was more appropriate to be dealt with in the recovery plan. But it was suggested that the calculations used to determine a geospatial component were tied to a number, so that number is relevant to this discussion. There was vague consensus that 7000 is okay as a working value, but that it will be modified when the recovery plan is drafted. What is more important is the calculations around that number.

It was questioned if there are guidelines for building targets separately from policy, purely from a scientific point of view. Also, would that be appropriate for the animals. This line of thought was not investigated too far.

The discussion backed up to focus on the how much space do we need for "X" amount of animals, and thus refining the density estimate in order to determine how much space is needed.

The authors were asked for their opinion on targets. They asked what the reviewers would like them to do.

Some philosophical debate took place around the wording of conservation legislation. The question was raised, "is the target to avoid extinction?" Under this assumption the targets become more refined. There was argument that recovery means prevention of extinction, and conversely that recovery means to maintain the status quo. Later in the discussion, SARA was pulled out and one participant brought forth the notion that SARA was also meant to prevent a specie from becoming further threatened (i.e., maintain the status quo). The discussion was guided back to targets.

It was made clear that the area of critical habitat is dependent on what the recovery targets are. The authors were informed that if you use MVP as the recovery target, they must formally state that and they must state reasons for this.

A participant mentioned that when designing the recovery plan, the distributional and recovery targets are taken from the RPA. In this case, the RPA is dated and there is new information about population and distribution, which needs to be tied into the RPA. In light of this, the

participant said that using 7000 as a conservation goal is sufficient, given that there is a lack of scientific information regarding appropriate targets at this time.

One participant indicated that he did not see it possible to designate an area of critical habitat without first defining a recovery target.

The point was made that, in order to justify a distributional target over a population target, you must be able to make the case that this target will prevent the animals from extinction.

There was a general feeling of discomfort around the number 7000, but also agreement that it is more conservative than past targets (i.e., 50 breeding pairs). As a side note, one participant suggested that in future meetings like this one, the recovery targets should be defined before the meeting as opposed to during the meeting. Generally, the sentiment was that great care should be taken in defining the recovery targets.

There was agreement that the title of the paper is wrong. It should be Recommendations for informing the identification of critical habitat for Speckled Dace.

The chair asked for opinions of which option is best: spreading the proposed 7000 across the three rivers, or 7000 in each river? One of the authors indicated that the 7000 comes from population modeling which is based on one connected population, but there is not much evidence that these populations are moving between the rivers. If there is regular exchange, you could justify 7000 across all three. There has to be a study done on migration, or on winter behaviour. There was no opposition to designating 7000 for each tributary. This was on the grounds that having three MVPs was in line with the precautionary approach.

The chair asked if there was agreement on protecting the whole width of the river. It was agreed to by some who felt that the habitat usage of the different life stages of the fish would justify protecting the whole width. Some comments were made about how it would be hard to defend against someone who wanted to use the river for their own purposes, due to our limited understanding of the species' biology. It was disputed that in fact we do know enough about the fish's biology to justify protecting the entire width. Also, it was mentioned that there is a new paper coming out by Andrusak that will shed more light on the lateral distribution of the species across the channel. There was some agreement that when more is known, it will be easier to defend the decision to protect the entire stream width. The group was reminded by one participant that while the literature may indicate that there is a need to protect the whole width of the channel, there are management implications. So decisions need to be defensible and robust.

The chair brought up the issue of prioritization of threats.

The authors said that the paper does indicate that the number one threat is low summer flows.

One participant asked about dissolved oxygen, and the authors said it is included in water quality analysis. Also, highway and railway crossings were considered, and it was stated that most crossings are below the proposed protected areas.

One participant indicated that there is a recent paper on water demand by Tarra White that the authors should have. The author indicated that the water demand on the whole river system is actually dropping as a result of declining population in the immediate area of the watershed.

The fact that the threat section is maybe not relevant to recommending critical habitat was brought up. One participant said that threats informs ALTDCH, therefore it is useful in the paper. It needs to be linked to functions features and attributes of critical habitat (i.e., "this threat will affect this feature function or attribute of critical habitat")

The issue of ski resorts such as Big White using water for snow production came up. It was suggested that the authors spoke more specifically about this.

In general, more detail needs to be put into table 3 but no one identified anymore threats that needed to be included in table 3. The authors agreed to update table three with some of the attributes suggested such as embeddedness. One participant did not want to see temperature included in table 3 because speckled dace are not temperature-limited. Including water quality in table 3 was discussed but it was resolved that water quality is better left for ALTDCH.

It was suggested that tables 1 and 2 go in the life history section, and table three in the threats section. This participant also suggested taking the information on flow rate range and depth range from tables 1 and 2 and combining it into table 3.

Including larval habitat preference was discussed. Most information on this is anecdotal observation. But one member mentioned that for Nooksak dace the larva hang out near the river margins because they can't swim very fact, and this is likely true for the speckled dace. Vague consensus was reached to list larval and juvenile instead of immature.

Attention was drawn to the flow preference discrepancy in table 1. The range was listed as 0.18-0.45m/s and the flow preference was listed as 0.06m/s. This seemed like a typo but apparently that is what is listed in Andrusak and Andrusak (2011).

The chair asked the meeting if there were any other functions, features or attributes that have been missed? The group resolved to include juvenile life stage, and remove overwintering and migration due to lack of information.

Should the authors take into account socioeconomic parameters? No, this definition of critical habitat has to be based solely on biology.

What needs to be included in the document to give flexibility in defining the geospatial boundaries in the face of socioeconomic demands? If the critical habitat is all the same in the river then there is inherent flexibility in defining the boundaries. But if there is one specific piece of river that is critical then the boundaries will not be as flexible.

The authors agreed that a study needs to be done in order to get a better understanding of migration/overwintering habitat. Also, a study to determine if the fish is territorial would help.

One of the authors indicated that the assumption is that these fish are sedentary and the larva recruit to the same area as the adults, and this justifies protecting a contiguous strip of river.

The chair asked if there was agreement on the linear density numbers proposed by the authors. The authors were challenged to defend the choice to protect a contiguous 2.4 km stretch of river. One participant asked why they can't protect 24 100m stretches, or 2 1.2km stretches. Do they have to be connected? This could allow one to exclude poor habitat and include only very productive habitat. However the original goal was to protect the population as one panmictic population.

One participant was concerned about the amount of variability in the capture efficiency values generated from the mark-recapture study. These values give a much higher total population estimate then if you just use the electrofishing density estimate alone. The density estimate dictates how much stream is needed to protect a target amount of fish, this value is very important to get right. This participant argued that there was lots of uncertainty in the low capture efficiency, and this should be considered when making the population estimate. In this participant's example, increasing the capture efficiency by only two fish per sample would cut the mean population estimate in half. It was recommended to use the lower confidence interval of the population estimate in order to be conservative. The author agreed with this

recommendation. This was deemed to be reasonable on the grounds that it recognizes the uncertainty in the capture efficiency and it fits with the precautionary approach.

The area of the mark - recap estimate was on the stream bank, and not in the middle where the recapture rates may get even lower. A lower rate may bring the population estimates back up. Also, depending on stream velocities the capture efficiency might be higher, which would push the estimate down. So it could go either way. t was debated whether or not it is necessary to be overly precautionary. But the uncertainty in the capture efficiency needs to be represented in the population estimate. The chair proposed that instead of listing a single number (mean) for the population estimate, list the value as a range between the lower bound of the confidence interval and the mean (~400-900k fish). Note that there is lots of uncertainty in the mean and management should take this into account.

The group agreed that at this point it is uncertain whether residency applies to the species. This should be a future study.

There was a discussion around why the authors do not consider riparian habitat to be critical. The authors need to link why riparian is not important to critical habitat. One participant seemed to think that riparian is critical simply because the Kettle is not a very deep or wide river, and so the riparian strip has to have an effect on the habitat. The author mentioned that sedimentation may be tied to riparian land, and this effects embeddedness, which is critical.

RECOMMENDATIONS & ADVICE

The primary activities likely to threaten Speckled Dace critical habitat include: excessive water draw-down during late summer (mainly agricultural) and sedimentation from forest operations. It appears that the human induced threats to Speckled Dace habitat have not increased over the last decade. The human population of the Kettle basin has declined slightly in numbers and increased in mean age. Forestry production has declined by 40% over the last decade.

There has been a major shift to unregulated groundwater extraction from more regulated surface water withdrawal. The impact of this shift warrants further studies.

Recommended critical habitat necessary to maintain the minimum viable population levels is 2.4 km of river (total width) in each of the upper Kettle (East Kettle), West Kettle, and Granby Rivers.

Further research should include population estimates within each of the three recommended critical habitat sites to insure these sites contain the population necessary to maintain and recover the species, examination of winter ecology and winter habitat use, and continued research on the extent and effects of groundwater versus surface water extraction.

ACKNOWLEDGEMENTS

The chair wishes to acknowledge and thank the authors for their hard work, Dr. Jordan Rosenfeld and Ms. Heather Stalberg for their reviews, and the active engagement of the participants to improve the quality of the scientific advice. Also, thanks to Nic Dedeluk of the CSAS office for coordinating and arranging meeting logistics and managing the webinar. Thank you to Mr. Ryan Abbott for being the Rapporteur.

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APPENDIX A: AGENDA

Information in support of the identification of critical habitat for Speckled Dace

Regional Advisory Process

Centre for Science Advice Pacific

April 19th, 2012

Chairperson: Sean MacConnachie

Time	Subject	Presenter
0900	Introductions Review Agenda & Housekeeping CSAS Overview	Sean MacConnachie
0930	Review of Terms of Reference	Sean MacConnachie & Participants
1000	Presentation of Working Paper	Harvey and Brown
1045	**Break**	
1100	Questions of Clarification	RAP Participants
1115	Presentation of Reviews & Authors' Responses	Reviewers & Author(s)
1200	**Lunch Break**	
1300	Discussion and Building Agreement on Conclusions, Recommendations, Advice and Future Work	RAP Participants
1600	**Adjournment**	

APPENDIX B: PARTICIPANTS

Last Name	First Name	Affiliation
DFO		
Abbott	Ryan	DFO Science
Bradford	Mike	DFO Science
Brown	Tom	DFO Science
Hwang	Jason	DFO Ecosystem Management Branch
MacConnachie	Sean	DFO Science
Nantel	Martin	DFO SARA
Schweigert	Jake	DFO Science
Stalberg	Heather	DFO SARA
Watts	Dean	DFO Habitat Biologist
EXTERNAL		
Andrusak	Greg	Redfish Consulting
Harvey	Brian	Fugu Fisheries
Rosenfeld	Jordan	UBC/BC Ministry of Environment
Waterous	Randy	Interfor, Grand forks
Wilson	Greg	Ministry of Environment

APPENDIX C: TERMS OF REFERENCE

Recommendations for the Identification of Critical Habitat for Speckled Dace

Regional Peer Review - Pacific Region

April 19th, 2012
Nanaimo, British Columbia

Chairperson: Sean MacConnachie

Context

Speckled Dace (*Rhinichthys osculus*) was listed in 2009* as Endangered under the Species at Risk Act (SARA). A recovery strategy and action plan must be prepared for Endangered species and included within one of these documents, the species' critical habitat. Critical habitat is defined in SARA as "the habitat that is necessary for the survival or recovery of a listed species and that is identified as the species critical habitat in the recovery strategy or action plan for the species". Under SARA section 41(1c) a species' critical habitat must be identified to the extent possible, based on the best available information.

DFO SARA Management Program has requested science advice in support of the identification of critical habitat Speckled Dace.

Objectives

The following working paper will be reviewed and provide the basis for discussion and advice:

Brown, T. and B. Harvey. 2012. Information in the support of the identification of critical habitat for Speckled Dace (Rhinichthys osculus). CSAP Working Paper 2011/P54

To provide the best available information regarding the geospatial extent of the critical habitat and its biophysical functions, features and attributes.

Expected publications

- CSAS Science Advisory Report (1)
- CSAS Research Document (1)
- CSAS Proceedings

Participation

- DFO Science, Oceans, Habitat and Species at Risk, Policy and Economics
- Province of BC
- External Reviewers
- Non-governmental organizations
- Other Stakeholders

*Corrected August 2012: Speckled Dace was listed under SARA in 2009, not 2008 as previously stated.

APPENDIX D: WRITTEN REVIEWS

REVIEWER: JORDAN ROSENFELD

BC. Ministry of Environment

Overview: This is generally a well-written and fairly comprehensive assessment of habitat needs of speckled dace based on current knowledge. My main criticisms concern lack of clarity around recovery goals and targets, and apparent inconsistencies in the degree to which proposed critical habitat will achieve recovery goals. In general, recovery goals and objectives need to be clarified, and a clearer scientific rationale needs to be provided to explain how the proposed critical habitat will achieve recovery objectives. I provide a more detailed critique below, dealing with the main issues in their order of appearance in the document, followed by more minor details.

Major Comments

1. Abstract

The statement "*Speckled dace are not habitat limited*" in the abstract is not supported by credible information, and may reflect an underlying misinterpretation of the meaning of limitation. A response variable like growth or abundance is limited by a factor when an increase in the factor results in a positive response. For instance, fish growth is food limited when an increase in prey abundance results in higher fish growth. Once prey abundance is in excess and fish are satiated, they are no longer food limited.

A population is not limited by habitat when increasing or decreasing habitat fails to generate a population response. It is not practical to do the necessary manipulation to test this with speckled dace, but one can do a simple thought exercise: if, say, 2km of linear river habitat were removed from the Kettle river, would one expect the population to decline? Insofar as the fish that are presently occupying that habitat would be gone after its removal, the answer would be yes. Similarly, if one were to somehow add an extra 2km to the valley bottom mainstem, would you expect it to be colonized and used by dace? Again, the answer is yes, indicating that there is every reason to believe that habitat IS limiting the population, and no reason at all to believe that it is not, as erroneously stated in the abstract.

Perhaps what the authors intended to say was that "*suitable speckled dace habitat is **abundant***", which is apparently true but quite different from saying that habitat is not limiting; this distinction is not a trivial one in a document on critical habitat.

2. Riparian Removal/Riparian Critical Habitat

The authors conclude in this section that riparian habitat does not warrant designation as critical for speckled dace, more specifically that "extending critical habitat into the riparian zone would not appear to confer any significant recovery benefit". In my view their arguments are not entirely convincing, and the authors need to make a stronger case that riparian does not warrant protection as critical by more explicitly considering the specific functions that the riparian zone provides in terms of habitat attributes and processes specifically relevant to dace. They need to refer to and reference Richardson et al. 2010 as an example of more systematically considering functions conferred by the riparian (see Richardson et al. 2010 Table 1, Do riparian zones qualify as critical habitat for endangered freshwater fishes? Can. J. Fish. Aquat. Sci. 67: 1197–1204 (2010)). If they disagree with aspects of the principles and approach laid out in this paper that's fine as long as they are explicit about why, but this is the sole paper published in the peer reviewed literature with specific reference to SARA and riparian habitat, and they cannot

credibly ignore it; to do so undermines the credibility of this assessment as a science document because it is not referencing the relevant published science.

It may be possible to argue that a historical loss of LWD does not appear to have jeopardized persistence of dace, insofar as they apparently remain abundant, although this remains speculative in the absence of knowledge concerning what dace abundance may have been in a historic condition when LWD was likely more abundant. However, this is an example of the sort of reasoning that the authors do not clearly lay out. A comparison of dace abundance in reaches with and without LWD could be one way of making inferences about this.

Note that for similar species – specifically Nooksack dace– a strong case was made that riparian does warrant designation as critical habitat, as described in detail in associated critical habitat documents, the Recovery Strategy, and Richardson et al. (2010). The authors need to more carefully identify how the context of habitat requirements for speckled dace with respect to riparian function in the Kettle differ from the circumstances surrounding Nooksack dace, which they do not presently do in a convincing way.

Finally, it is noteworthy that on page 16 the authors write that "Andrusak and Andrusak (2011) consider water extraction and damage to riparian habitat the chief threats to speckled dace." Although details are not provided, the conclusions of Andrusak and Andrusak contrast strongly with the analysis presented in the riparian section of the draft document.

Some of the ancillary information and logic provided in this section is also flawed or unclear, e.g.:

According to the information on page 19, large wood is "noticeably absent" in the Kettle River. This is attributed in large part to historic riparian logging associated with forestry and/or land clearance. The text further states that "It is questionable whether the Kettle River Riparian Zone has had much of a role in supplying LWD to the system for many decades.", presumably because of the history of riparian logging and fire. One could therefore make a reasonable inference that physical structure in the Kettle river is degraded with respect to a historic natural condition in terms of a loss of structure (pools, complexity) associated with LWD. This would support designation of the riparian as critical for fish that are pool-dependent such as salmonids, but might not for species that are not as strongly pool-dependent, which may include speckled dace; however, this sort of logical inference specifically relating channel attributes conferred by riparian processes to habitat requirements of dace are not clearly laid out, and they need to be in a more systematic way (again, refer to Table 1 in Richardson et al. 2010) to support the inference that riparian does not warrant designation as critical. However, for the particular example above note that Andrusak and Andrusak (2011) state that larger mature speckled dace occur in deeper "run or pool habitat", although "not necessarily in association with wood that often formed the pools". This statement indicates both an important role of wood in pool formation in the Kettle, as well as use and importance of deep habitat by mature dace. In addition, on page 8, the authors state "If deep pool habitat proves important for larger speckled dace, as these preliminary results suggest, then its relative scarcity in the Kettle drainage may prove to be a limiting factor." This statement appears inconsistent with statements that minimize the importance of LWD inputs from the riparian.

There are also some other errors that are of note in this section:

- "Cottonwoods and aspen disintegrate within a few years after falling in the river." – this may be true for aspen, it is not true for large cottonwoods, which can be keystone trees in jams for decades (see Collins et al. 2002 Can. J. Fish. Aquat. Sci. 59: 66–76 (2002). Cottonwood can also grow to a large size that can be channel-spanning in smaller rivers, even if they have relatively high decay rates.

- The authors state "it is difficult to establish stable woody debris in a channel filled with mobile substrate." In fact, LWD plays a significant role in gravel- and cobble-bed streams and rivers where much of the substrate is mobilized at high flows. At the opposite extreme, LWD will in fact play no role in a channel where the sediment is so large that it is not mobile. The italicized statement is true to some extent in rivers that are very highly aggraded, but it is not clear that the Kettle River is extremely aggraded. If it is, then identifying the source of sediment becomes a key priority for channel restoration.
- The authors state "few riparian trees of appropriate size or species are available to provide large woody material". This would seem to directly support the inference that lack of riparian protection has contributed at some level to an absence of suitably sized riparian trees as a source of LWD, unless absence of large riparian trees is a normal feature of the natural riparian zone, which seems unlikely.

3. Recovery Targets and Critical Habitat

As the authors note on Page 2, identifying critical habitat is a process of determining the relationship between habitat area and fish abundance, and then determining how much habitat is required to meet a recovery target. Unfortunately, the document lacks clarity and transparency on what the recovery targets are, and the degree to which the suggested area of critical habitat will be successful in achieving recovery targets.

To add to this confusion, the authors state on page 20 that "*The present paper takes the view that, for speckled dace, the term "recovery target" is largely irrelevant.*" This is a troubling statement that suggests a poor understanding of the basic concept of recovery and conservation of species at risk. Recovery targets are the foundation of transparent and defensible conservation, and are important to define clearly so that management is focused on achieving specific outcomes.

Recovery targets can have both population size and distributional objectives. A Minimum Viable Population (MVP) is one common population benchmark for recovery. For species that are well below a MVP, a MVP is a realistic and logical conservation target. However, a MVP may not be an appropriate recovery objective in many cases, particularly when the current population exceeds a MVP. For example if a recovery goal is "to maintain current distribution and abundance" for a species with a moderate distribution, maintaining that distribution may require populations that are well in excess of a MVP. Another way of thinking about this is that if population size of a listed species exceeds a MVP, a recovery target equivalent to a MVP explicitly allows the current population to decline to that level, which would be inconsistent with a basic recovery goal of "maintaining current distribution and abundance". This would represent a minimalistic approach to conservation, and undermines the fundamental objective of preventing the status of listed species from declining. Arguably, the goal of "*maintaining current distribution and abundance*" or "*prevention of decline*" is most appropriate in this case.

The authors state on page 20 that the RPA for speckled dace identified "*preservation of the species' current distribution*" as the recovery goal. The authors then interpret this as a either i) a single MVP in the Kettle River, or ii) 3 MVPs, one each in the mainstem Kettle, West Kettle, and Granby rivers.

The meaning of "*distribution*" is to some extent subject to interpretation. Maintain "*current distribution*" can be interpreted, at the very largest spatial scale, as meaning the maintenance of populations (MVPs or larger) in all of the major occupied watersheds within a species distribution, at a smaller scale as presence in all the major tributaries of these watersheds, or the maintenance of fish presence in the reaches that are currently occupied (i.e. the linear area of occupancy in Figure 2 of the working critical habitat document).

The Recovery Potential Assessment for speckled dace states that "*An appropriate distribution target for recovery should, in the absence of any evidence that distribution has changed significantly, reflect the need to maintain the status quo, namely to preserve the current distribution in the West Kettle, Kettle and Granby Rivers and their side channels.*" This suggests that the intent of recovery as articulated in the RPA is to generally maintain the current distribution at the reach scale (a distributional target), although the RPA does not specify a population recovery target.

The proposed population recovery target in the critical habitat document under review is 3 MVPs in each of the main Kettle tributaries, each with population recovery targets of 7000 mature fish, over a 7km linear length of river channel in each case. The authors state on page 21 that "*The area identified has been chosen to be sufficient to achieve the population and distribution objectives for the species.*" This statement deserves scrutiny. While the proposed designation seems more than sufficient for achieving the population recovery target of a Minimum Viable Population (but not a target of "maintain current abundance"), it does not appear sufficient to achieve the distributional objectives as stated in the RPA (*to preserve the current distribution in the West Kettle, Kettle and Granby Rivers and their side channels*). The authors need to more clearly and convincingly articulate the rationale for how the proposed critical habitat area will achieve this distributional objective, as the chain of logic that would lead to this conclusion is unclear.

In addition to the 2 scenarios for critical habitat that are presented (one MVP in the Kettle, 3 MVPs distributed in the major tributaries) there are other critical habitat configurations that should be considered in terms of their ability to meet distributional (or population) recovery targets. The first would be to designate the entire current distribution as critical. This would be consistent with the recovery target of maintaining current distribution (and also maintaining current abundance as well). The authors should specify clearly in the report why they think it inappropriate to identify the current distribution as critical. The second option is to identify as critical less than the current distribution, but to do so in a way that could be argued is likely to meet the target of *maintaining current distribution*.

The authors chose to place the 7km of proposed critical habitat at the upstream end of the distribution of speckled dace in each major tributary. The rationale for this was that this location was, for the most part, upstream of most water withdrawals, which would protect critical habitat areas from potentially negative effects of flow abstraction. This logic is sound, however it may be unwise to locate critical habitat, or certainly all of it, near the upper edge of a species distribution. There may be a reason why it represents the upper limit of a distribution (it is approaching some unknown environmental limitation, for example), and this upper end could be sensitive to environmental change (climate or other) that could alter it. It would therefore seem a more robust option to take a portion of the 7kms (or designate an additional stretch of habitat) in each tributary and locate it further downstream; this is also a logical bet-hedging strategy to reduce risk from stochastic/catastrophic events. In addition, locating several additional downstream critical habitat patches in each major tributary would go much further towards the recovery goal of "*maintaining current distribution*", rather than protecting only the upper extremes.

An inference throughout this draft document has been that habitat is homogenously distributed throughout the distribution in terms of quality. This may be true, or it may reflect a lack of understanding of what constitutes good habitat quality for speckled dace; for instance if deep fast habitat with large substrate is preferred by larger adults (as indicated by Andrusak and Andrusak 2011) which contribute disproportionately to the spawning population, then protecting this habitat may be disproportionately important. While some of this habitat may be present in

the upper sections, placement of critical habitat patches further downstream might be more effective if they targeted these habitats.

Finally, it is noted on page 7 of this report that no mature dace are found in the West Kettle in the autumn, suggesting a fall downstream migration. If this is indeed the case, then it makes an argument for both protecting downstream habitats (i.e. upstream habitats may not provide adequate seasonal habitat for all life stages), and for identifying the location and attributes of downstream habitats that may be important for overwintering. The Fig. below illustrates an example of additional critical habitat patches (red circles) added in downstream locations in a configuration that arguably does a better job of "*maintaining current distribution*" (note that location of circles in this example is somewhat arbitrary, and in practice would have to be informed by site attributes).

Figure 1. Proposed critical habitat

Minor Comments

1. Page 2 – "critical habitat is not necessarily the same thing as "all habitat" for a species, because some habitats are more important for a species than others." This is true, and is based on the inference that if you cannot protect all habitat, habitat should be prioritized so that the most important habitat is the habitat that gets protected. However, as presented for speckled dace, habitat is inferred to be (or presented as) homogenous; in this case there are two approaches:
    i. it doesn't matter what habitat you protect, it's all the same so it's substitutable; or
    ii. the inference of homogeneity is due to lack of knowledge on our part, and since we don't know which habitats really are important then we should be precautionary and

protect all habitat. The presence of an apparent seasonal migration to who knows where suggests a bit of the latter.

2. Biology, Page 3 – "a hybrid" is awkward wording, seems appropriate for an individual fish. Try "...evolutionary origin is believed for be from a past hybridization event between leopard and speckled...".

3. Mature Feeding Habitat, Page 7. Andrusak and Andrusak (2011) found that mature fish were most likely to be found in deeper run and pool habitat at higher velocities and not at river margins. In contrast, Batty (2010) found that density was highest in marginal shoreline areas. There is a serious inconsistency here that is ignored or downplayed – the authors conclude that Battys findings "agree with the findings discussed above", in direct reference to the observations of Andrusak and Andrusak that mature individuals are present in deeper faster habitat. The authors should revisit the original sources and try to reconcile these observations. The authors also state "*Mature fish were most often observed where water velocity was between 0.18-.45 m/s, with a "velocity preference" of .06 m/s*" ; this makes no sense, and I assume the 0.06 m/s is a typo.

4. Page 8 – "*If deep pool habitat proves important for larger speckled dace, as these preliminary results suggest, then its relative scarcity in the Kettle drainage may prove to be a limiting factor.*" This statement appears inconsistent with later statements in the document that deeper pool habitat and LWD inputs that create it are not important.

5. Page 10 "*there is no suggestion that habitat presently limits the persistence of speckled dace in Canada*" – this statement should be modified to "severely limits", i.e. insert "severely" in front of "limits". Let's do a thought exercise – suppose a small asteroid landed in Westbridge; its radius of impact effect is exactly 36 km, and it wipes out the Kettle River population of dace and unfortunately much of the local human population. Alas, if the distribution of dace had included the next watershed over they would have persisted. Therefore habitat is potentially limiting their persistence, albeit under an extremely unlikely scenario.

6. Pg. 10 Given the concerns over flows, it might be a good idea to try to identify flow refugia, i.e. areas with groundwater inputs or simply consistent flows that would be valuable to protect (as much for salmonids as for dace).

7. Pg 12 warmer winters could have a positive effect on growth or survival, but lower summer flows could have a worse negative effect. It depends on the relative magnitude of changes and where the population/life-history bottleneck is most severe.

8. Pg. 15 – Ideally, compensation funds from the Cascade hydro project should go to long-term monitoring of status and habitat assessment/study, not just for the project footprint but ideally for the population as well ($30-40,000 a year or every couple of years would do the job).

9. Pg. 16 Keeping invasive species out has to be a management priority.

10. Pg. 19 Proposed critical habitat section in the West Kettle is 1-5% gradient – this seems quite steep. I'm not familiar with the Kettle, but this raises the question of whether it's the best habitat to designate as critical, i.e. are lower gradient sections better? Or is the larger substrate in steeper sections better? Uncertainty suggests spreading the habitat around to some extent is a good idea.

11. Page 24. Knowledge gaps. Understanding what constitutes overwintering habitat (why mature dace leave the West Kettle in the fall) seems important, since it suggests that something important may be going on in terms of seasonal habitat dependence.

12. Establishing monitoring sites in critical habitat is important (ideally based on the Batty or Andrusak sites). Putting some resources into long-term monitoring outside of critical habitat is also important, i.e. to track status of the entire population if the complete distribution is not identified as critical.

13. Nelitz 2011 is not in refs; DFO 2011 is not in refs.

REVIEWER: HEATHER STALBERG

Species at Risk Act Senior Recovery Planner
Ecosystems Management Branch

I provide Key Comments followed by Specific Comments and have referred to some of these in responding to typical peer review questions first.

Q1. Is the purpose of the working paper clearly stated?

- For the most part, though the scope of the threats needs to be clarified. I provide further detail in Specific Comment #5.

Q2. Are the data and methods adequate to support the conclusions?

Q3. Are the data and methods explained in sufficient detail to properly evaluate the conclusions?

- The approach of MVPA to identifying critical habitat (CH) is well rationalized, but the supporting data and calculations used to generate the two Methods (options) is missing. I provide further detail in my Key Comments 1-3.
- A pathway of effects approach to linking the threats to the CH function, features and attributes is needed to substantiate them. And, while one of the threats is expressed as the highest risk, prioritization criteria isn't provided. I provide further detail in my Key Comments 7-9.

Q4. If the document presents advice to decision-makers, are the recommendations provided in useable form, and does the advice reflect the uncertainty in the data, analysis or process?

- Given the species is not habitat limited, exploits a wide array of habitats throughout its life cycle and has a robust population distributed throughout various habitat types in the system, the authors approach to identifying CH which is based on a conservation target for maintenance of the population is practical and appreciated. The recommendation of locating the CH in stream sections where the likelihood of disruption by any of the known threats, as well as any potential conflict with human activities is minimized too is practical and useful.
- The CH map is helpful.
- The uncertainty or risks associated with each CH ID Method should be expressed. The uncertainty of the relationship between the threats and the CH can be better expressed. The Knowledge Gaps and Schedule of Studies sections have a number of worthy suggestions; review comments are provided on making the advice more concise and consistent with recovery planning commitments. I provide further detail for these points in Key Comments 3, 7 and10.

Q5. Can you suggest additional areas of research that are needed to improve our assessment abilities?

- I provide further detail in my Key Comment #10.

Key Comments

1. Section 8 Recovery Targets (Population Benchmarks)

Given our greater understanding of population size and its substantial increase from previous estimates and the uncertainty on population trend, specifying a conservation target for the maintenance of the population vs. defining a particular population level as a recovery target in

this situation is appropriate. Utilizing Reed et. al.'s (2003) 7000 adult vertebrates to define this maintenance target too is reasonable.

2. Section 9 Methods and Approach Used to Identify Critical Habitat

Applying Batty's 2010 abundance estimate to the 7000 mature fish to gain the habitat required to support this conservation level also makes sense. However, I can't determine from the paper how the 0.3 fish/m was selected as this metric. Table 12 in Batty (2010) provides linear densities and 0.3 is not within it. Further, and more importantly, the linear densities are not corrected for capture efficiency as they should be, and so represent the number actually caught by electrofishing and not what was fully used to determine the population. The average capture efficiency was 0.079, so the corrected linear density is, if using the mean for the whole river of 0.229, 0.229/0.079= 2.89 fish/m. This order of magnitude difference has significant implications on how much habitat is then required to support 7000 mature adults i.e. 7000 fish/(2.89 fish/m)=2422 m or 2.4 km. The report specifies "*7.2 km or 21.4 km of proposed habitat within each of the upper locations*" but doesn't show the calculations as to how these figures were arrived at. Showing this information would help, as I may simply be missing something in my calculations which was considered by the authors.

3. Section 9 Methods and Approach Used to Identify Critical Habitat

If I understand correctly, the authors pose two choices as to how to distribute the 7000 individuals, either divide this into thirds between the three tributaries (Method A) at 7.2 kms per tributary or keep 7000 individuals in one tributary (Method B) which requires 21.4 km. (Shouldn't this be 21.6 km?) There is lack of clarity in how these two options are described on page 23 in the paper "*If we assume 0.3 fish/m as a reasonable estimate of abundance (Batty 2010), we arrive at 7.2 km of proposed critical habitat (Method A, Figure 2) or 21.4 km of proposed habitat within* ***each*** *of the upper locations (Method B; Figure 2).* This reads as if there could be 21.4 km in each of the three tributaries. Again, showing the calculations would help. It would be helpful in determining the best option if the authors could describe any associated risks and how they compare i.e. is one more risky than the other. For example, is there risk to the productive capacity of the CH if it is broken-up into 1/3rds as it might not encompass sufficient habitat diversity required to produce 2350 fish?

This is one population distributed across different locations. They aren't independent of one another, and there is a probability of natural exchange. The authors have cited literature that states the dace have dispersal ability and Batty (2010) thought there were enough dace in each tributary to affect rescue if there was a catastrophic event in a tributary. Also, the length of stream determined to generate 7000 individuals will be conservative (likely producing more than 7000 individuals) because, even beyond correcting for catch efficiency, Batty's 2010 density estimates might have been biased to capturing smaller and less individuals due to use in the daytime vs. the nighttime and, there were spans of river not sampled which could also influence range and abundance. Based on the foregoing, my inclination is to apportion 1/3rd of the CH to each of the West Kettle, Kettle and Granby Rivers.

Regardless of which Method is chosen, the calculations that generated 7.2 km and 21.4 km for Method A and B respectively need to be presented and accuracy confirmed.

4. Section 9 Methods and Approach Used to Identify Critical Habitat

Locating the CH in stream sections to minimize the likelihood of disruption by any of the known threats, as well as any potential conflict with human activities, is pragmatic and helpful.

5. Section 9 Methods and Approach Used to Identify Critical Habitat , CH Table 3

a) Table 3 would be clearer if it had the Life-Stage as the first column with rows for Immature and Mature. The 2nd column would be Function. I'm not sure if Feeding is the best term for the Function; it seems too narrow, particularly as the authors have appropriately not listed as attributes the wide-range of items the species has been found to consume. I'd suggest using a more inclusive term, such as rearing for both immature and mature, which then allows for additional functions such as taking cover. Another Function for Mature would be Spawning as the authors have included.

b) Table 3 includes Migration and Overwintering as Functions. I'd suggest that we don't know enough about these functions to include in the table at this time. Andrushak (2011) has suggested a fall downstream migration, but we don't know more than this based on the CH ID paper's narrative. The suggestion to examine this in Knowledge Gaps/Further Studies is more appropriate.

c) It appears that we do know enough about embeddedness to include as an attribute in Table 3. Andrusak (2011) found juveniles preferred low-moderate embeddedness and adults low embeddedness. Batty spoke to clean gravel for adults (mid-July) for spawning and cited Peden as juveniles and adults both using clean gravel with little or no organic matter.

6. Section 6. Important Habitat Attributes

What distinguishes important habitat attributes from critical habitat attributes isn't specified. I'd suggest to avoid confusion, the various study data (e.g. Andrushak's, Batty's)that relate to the attributes listed per life-stage in Section 5, which are currently in Section 6 and in Section 9 as Tables 1 and 2 be moved to Section 5 along with the narrative from Section 6, but without the moniker Important. Then, in the subsequent CH section the functions, features and attributes that are selected/summarized as CH are described and tabled, such as Table 3. The result is that CH is then a sub-set of what is found in Section 5.

7. Section 7 Land and Water Uses that Threaten CH

a) This section will have more utility if placed after Methods and Approach Used to ID CH. This allows for a clear relationship of the threats to the specific functions, features and/or attributes of the CH via a pathways of affects process to be portrayed; a needed relationship. If there are a number of threats that really affect the individual and not the CH (see Alien Species below), a different approach can be taken where the broader scope is clarified and the threats are separated into those to the individual vs those to the CH. The linkages to functions, features and/or attributes would still need to be made where possible for those threats to CH.

b) There is substantial information pertaining to the threats that helps to build an understanding of them. The authors have stated that the threat with the highest risk to dace is reduced summer flows. However, how the authors came to this relative priority isn't provided. A consistent means of prioritizing the threats would be helpful as it is a requirement during the recovery planning stage for all threats and it ultimately helps prioritize future management efforts in tackling them. There are a number of different ways the threats can be prioritized e.g.

   i. Environment Canada's Species at Risk Act Implementation Guidance DRAFT-Guidelines on Identifying and Mitigating Threats to Species at Risk, February 1, 2007. This is the current requisite for SARA recovery planning.

   ii. BC Freshwater Fish Threats Assessment Tool, by Todd Hatfield, Graham Long and Sue Pollard.

I would ask that whichever approach the authors take, it be applied explicitly and consistently so that it can be more easily converted into the requisite format for recovery planning. Also, some of the threats in the paper speak to likelihood of them occurring; this is an extremely helpful consideration in prioritizing as SARA requires the identification of activities likely to destroy critical habitat (ALTDCH) and we'd be looking to this document to help inform that piece during recovery planning.

c) As per 7a, the threats need to be linked to how they effect the function, features, or attributes of the CH where known, to facilitate future management and protection efforts. The following document can be referenced to confirm if all of the affect pathways have been captured.

Coker, G.A., Ming, D.L., and Mandrak, N.E. 2010. Mitigation guide for the protection of fishes and fish habitat to accompany the species at risk recovery potential assessments conducted by Fisheries and Oceans Canada (DFO) in Central and Arctic Region. Version 1.0. Can. Manuscr. Rep. Fish. Aquat. Sci. 2904: vi + 40 p.

The paper doesn't capture the relationship in most cases; I've provided some e.g.'s below. This list isn't exhaustive.

i. 7.1 Water Withdrawal

There is a lot of specific information before some of the most salient information is provided. Can the authors at the outset speak to:

- Is the long-term water supply decreasing and what is the supporting evidence? It isn't until the 4th paragraph that the narrative states "*Lowest flow in drought years has decreased from 1929 to 2003, probably due to a combination of climate change and an increase in water use*". This is helpful and will be more so if supported by references.
- Is the demand for water increasing or decreasing and what is the substantiating evidence e.g. is there any monitoring or anecdotal information to support a conclusion one way or another?
- Is the system fully or oversubscribed according to the Province or are further licence allocations being considered?
- And, the authors have well covered what our (lack-of) understanding is on the relationship between surface flows and groundwater and recharge rates.

Answers to these questions provide a quick picture of our understanding of the current water resource and potential changes. Then, how changes to water supply could affect speckled dace CH functions, features and attributes can be explicit. The last paragraph states "*changes in flow levels combined with climate-induced changes in temperatures and precipitation may be expected to affect speckled dace*" but doesn't say how. Is it going to reduce available cover, is decreased discharge going to increase embeddedness, etc.? Given the species exploits a wide array of habitats throughout its life cycle, has a robust population distributed throughout various habitat types in the system, maybe there is too much uncertainty to make this connection. If so, then this can simply be stated. If there are any conclusions on affect, they should be substantiated.

ii. 7.4 Alien Species

There is substantive discussion on the plethora of alien species in the system and potential negative effects on biodiversity. Biodiversity needs to be examined though in

its linkage to CH. Is biodiversity affected by the speckled dace being consumed and they are thus lost from the species composition of the system? If so, this is a threat to the individual, not to the CH. Or, are there threats brought about by these invasives that negatively affect the CH e.g. (hypothetically) didymo smothers the substrate significantly reducing Speckled dace cover.

iii. 7.5.1 Timber harvest

There is a substantial amount of discussion around the fire return interval but the paper doesn't make the connection to forest activities and subsequent implications to CH function, features, attributes.

iv. Pg. 17 provides a list of (potential) affects that harvesting can have. It would be useful to clarify likelihood of these affects, as it seems that they may be lower given the following narrative on road construction being the biggest threat. Is this because they are well mitigated? If the threats are likely, the impact on CH should be described.

v. Pg. 17 provides useful narrative on the threat of road construction and potential impacts. Again, this should be clearly linked to the CH function, features and attributes. The anecdotal evidence referenced says the impacts of forestry in the Granby River have made an area almost devoid of Speckled dace. Do we know if dace were in these places to begin with, and, are these areas outside of the proposed CH?

vi. 7.5.2 Mountain pine beetle and salvage logging

There is substantive discussion on mountain pine beetle infestation in comparison to other watersheds, hydrological effects, and tree removal mitigation measures to minimize potential stream habitat damage. It would be helpful if the document clearly stated what the likelihood of impacts to CH function, features, and attributes could be (if known) when the hydrological changes are coupled with the salvage logging e.g. could flows or substrate integrity be affected? The following reference found that beetle kill has a smaller impact on peak flow than the cumulative effect of both beetle kill and clearcut salvage harvesting.

Quantifying the water resource impacts of mountain pine beetle and associated salvage harvest operations across a range of watershed scales: Hydrologic modeling of the Fraser River Basin. 2010. Schnorbus, M.; Bennett, K.; Werner, A. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, BC. Information Report BC-X-423. 64 p

I don't know if all of the mitigative measures for salvage logging expressed in 7.5.2 were undertaken in the area of this research study but perhaps this study could help inform likelihood.

I note the Nelitz 2011 was not in the References.

vii. 7.5.3 Wood Processing states there is a limited threat of point source pollution. How does this point source pollution affect the CH? There is also a discussion about the export of timber from the area. Does this have any effect on CH? If not, then it is not relevant.

viii. 7.6 Riparian removal

The paper states "Riparian logging and the clearing of land for agriculture and ranching can increase the rate of bank erosion and sediment deposition". How this affects CH

should be linked e.g. loss of substrate cover through in-filling of substrate interstitial spaces perhaps.

d) Riparian removal

Pg. 19 states "adequate protection of riparian zones from cattle and private land clearing is a concern at specific sites." It then goes on to note that bank stability could be addressed through livestock exclusion. I'd suggest that cattle access to the stream be a separate threat from riparian clearing and the pathways of effects specified.

8. Are any of the threats likely to destroy critical habitat after typical mitigation is applied?

Destruction being considered as *"Destruction is determined on a case by case basis. Destruction would result if part of the critical habitat were degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from a single or multiple activities at one point in time or from the cumulative effects of one or more activities over time. When critical habitat is identified in a recovery strategy or an action plan, examples of activities that are likely to result in its destruction will be provided."*

If there is an insufficient level of certainty either related to likelihood or impact, then a threat shouldn't be considered an ALTDCH. Perhaps the authors have already concluded this and that is why none of the threats have been identified as such. An explicit statement to this effect should then be provided. If there is/are ALTDCH, it would be helpful to follow the threats discussion with a section on ALTDCH; a recommended format with mock information is provided below. Company names shouldn't be included.

Table 1. Activities likely to destroy critical habitat

Activity Likely to Destroy CH	Effect Pathway	Function Affected	Feature Affected	Attribute Affected
Land clearing for agriculture and ranching	Riparian removal leading to bank erosion and sedimentation which fills in interstices of substrate	Cover	Substrate	Embeddedness
Cattle access to the stream	Break-down of stream-bank integrity leading to erosion and sedimentation which fills in interstices of substrate	Cover	Substrate	Embeddedness

9. Riparian Removal

I agree that riparian is not a feature of CH. Tackling the subject of why it isn't is appropriate given the expected questions around the subject during review of both this paper and at the recovery planning phase. However, the discussion is better placed in an Appendix rather than in the threats section, 7.6 Riparian Removal.

The discussion on why riparian doesn't appear to confer any significant recovery benefit (pg. 19) can also be more thorough i.e. why the majority of its typical functions are not essential for the survival or recovery of speckled dace. I'd suggest listing all the typical functions riparian

provides (e.g. shade, cover via large woody debris, cover via undercut banks, erosion protection, support of terrestrial invertebrates as food source, support of aquatic invertebrates as food source) and then discounting those not required in this situation. For example:

a) riparian provides shade but this is not a requisite for the speckled dace as they are more tolerant of higher temperatures than say salmonids

b) riparian provides invertebrates however Batty 2010 (Figure 14) found a wide range of invertebrates, algae and plant material consumed by dace, and discussed that location (narrow headwater vs. wide lower gradient system) influenced their consumption patterns as well and

c) riparian provides cover, however these fish have been found to predominantly take cover in the substrates and Andrushak (2011) found immature and mature dace had no preference for woody debris and mature dace had no preference for overhanging vegetative cover.

10. Section 10 Knowledge Gaps and Section 11 Schedule of Studies

a) I suggest that these sections be combined into one section e.g. Further Research Needs. One, because two of the three studies within Schedule of Studies are more detailed descriptions of those listed in Knowledge Gaps. Secondly, Schedule of Studies is a term specific to recovery strategies and the studies listed therein are Ministerial commitments. We don't want to appear to fetter the Minister's discretion in this regard.

b) If it can be done, research on dispersal would be helpful as it could have implications on location of CH.

c) It would be useful to briefly provide a purpose for each study which would then help to prioritize them e.g. Accurate biophysical descriptions of the proposed critical habitat locations. Is the purpose to monitor potential changes in productivity over time, to build quantitative relationships between the habitat features and number of dace produced or other?

d) The first study under SOS A detailed assessment within each of the proposed critical habitat locations to verify the length of stream required to maintain the population above the target level. Why is this to maintain the population above the target level and not at the target level? The purpose of delineating the specific length of stream was to produce a target of 7000 individuals, not above this.

e) The last sentence in SOS pertaining to work coordinated by the Kettle River Technical Advisory Committee is better placed in the threats description on Water Withdrawal.

Specific Comments

1. Recommend the title of the document be modified from "The identification of critical habitat for speckled dace (*Rhinichtys osculus*) (Kettle River population)" to Proposed critical habitat for speckled dace *(Rhinichthys osculus)* to avoid confusion as to when the protection prohibition comes into force. Protection has to come into force 180 days after the recovery strategy or action plan that identified the critical habitat is included in the public registry, the public might misconstrue that once this paper identifies CH the prohibition process starts. Also, I have removed the (kettle river population) as it implies to me that there are other populations of Speckled dace in Canada which would be incorrect, however there might be a rational in naming conventions that I am not familiar with that requires this.

2. The preamble states "The geospatial and biophysical identification of CH is based on the best information available, bearing in mind that critical habitat identification is an iterative process. As DFO (2011) makes clear, that process is completed "only when the population

and distribution objectives necessary for the survival or recovery of the species have been achieved." I note that the draft CH Identification Guidelines referred to are in revision to clarify that CH doesn't keep getting identified until the population and distribution objectives are achieved. Instead, the iterative process of CH identification is complete when the quantity and quality of CH identified is sufficient to achieve the population and distribution objectives stated in the recovery strategy for the species. This revision should better manage expectations around the process.

3. To put the narrative into spatial context, the document would benefit greatly from a graphic early in the document that shows the names of the systems that will be referenced throughout the paper, the main communities and landmarks that are referenced e.g. Beaverdell, Midway, Cascade Falls, etc..
4. Page 2 2nd paragraph states that a species like speckled dace should have critical habitat identified for each life history stage. How are they different than other species should be made clear.
5. Pg. 2, the 2nd to last sentence of the introduction contains the purpose of the study which includes that the paper will reflect "any changes in human-induced threats to the population". However, Section 7 is headlined as LAND AND WATER USES THAT THREATEN CRITICAL HABITAT which implies a more specific scope. The narrative in the threats section then seems to include threats that are outside this scope e.g. alien species. The threat scope in the introduction and the subsequent sections and narrative should be confirmed to be consistent.
6. Page 5, Distribution and Abundance within Canada should also reference Andrushak's survey work on the Inonoaklin River which confirmed absence of Speckled dace.
7. Page 6 2nd paragraph says "Such abundance estimates need to be repeated, including at different times of year and during different water flow, in order to gain confidence in the estimates." I'd suggest Batty's estimate and range is sufficient and that it is more relevant to evaluate long-term trends in population. This study suggestions should be moved to Future Studies.
8. Page 7. Mature feeding habitat. The paper refers to finding no mature dace in the West Kettle, which Andrushak has interpreted to suggest that there is a large-scale downstream migration in the fall. Do the authors of this paper support this and is there anything to substantiate this conclusion? Do the dace move back upstream? Being clearer here about what we know and don't know will then help with what goes into Future Studies.
9. Page 11. Paragraph 4 in Water Withdrawal states "that even during those times when natural flow in the sub-basins is estimated to provide the recommended level of flow for fisheries, ..." It would be helpful to clarify if fish flows have been specified for the Kettle and what those fisheries are i.e. does it include Speckled dace.
10. Page 11. Paragraph 5 in Water Withdrawal states "Water abstraction for irrigation in the Kettle basin has been identified as a conflict with fish habitat for many years (Bull 1973)." Again, it should be clarified if the fish habitat includes Speckled dace.
11. Page 12 The first paragraph states "A sensitivity analysis for the Grand Forks aquifer (Allen et al. 2004) indicated that the available water is substantially more than that required for additional allocations, but much less than required for in-stream fish needs." Again, what were the in-stream fish needs and did the fish include Speckled dace? These three preceding similar points are asked to ensure that if the research was done on other species

e.g. salmonids it isn't simply extended to Speckled dace, which can have different habitat requirements.

12. Page 13. The last paragraph of Irrigation relates to pollution from multiple sources and doesn't fit with irrigation.

13. Page 15. The last paragraph of Sect. 7.3 speaks to the administrative process of development proposals in relation to the Fisheries Act and SARA and isn't necessary for this paper. Except for retaining the last sentence, "the project area is outside the CH boundaries proposed in the present paper" I suggest the remainder of the paragraph be replaced with a simple "the project is in the review process." More helpful would be information on relating potential impacts to functions, features, and attributes and, if there are any other Independent Power Production hydro projects proposed in the system.

14. Page 19. The riparian removal discussion states that cottonwoods and aspen disintegrate in a few years. This is understating the longevity in the water of these species. While they persist for shorter time periods than softwoods, I wouldn't expect full size cottonwood trees to decay in less than a couple of decades.